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PATENT ABSTRACTS OF JAPAN

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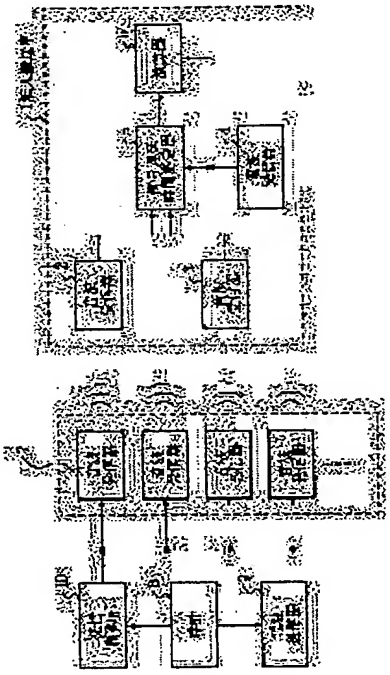
(54) DEVICE FOR MEASURING POSITION OF UNMANNED CARRYING VEHICLE

(57)Abstract:

PURPOSE: To accurately obtain the position and attitude of an unmanned carrying vehicle.

CONSTITUTION: A transfer control part 10 transmits sound wave successively from each of a sound wave transmitter 7 in synchronization with the signal from a clock 8. A radio wave transmitter 9 sends the signal from the clock 8 to an radio wave receiver 4 of an unmanned carrying vehicle 1 with an electric wave. The unmanned carrying vehicle 1 receives sound waves from each of the sound wave transmitter group 7 using sound wave receivers 2 and 3, compares them with the signal of the clock 8 received by the radio wave receiver 4 using a signal delay time measuring instrument 5, specifies from which sound wave signal machine the sound wave comes and then obtains the propagation delay time, and then obtains the distance from each sound wave transmitter to the sound wave receivers 2 and 3 using an operator 6, thus obtaining the position of the unmanned carrying vehicle.



* NOTICES *

CLAIMS

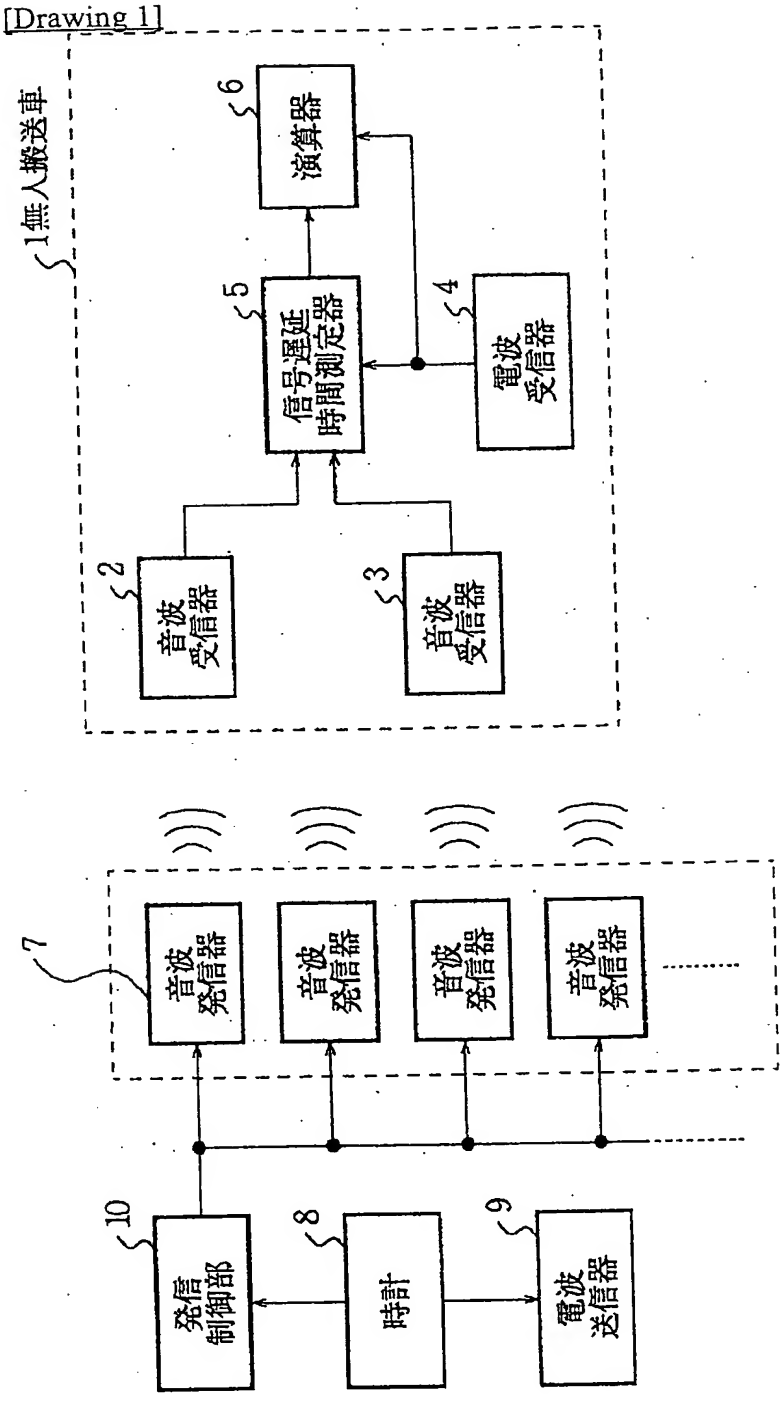
[Claim(s)]
[Claim 1] Two or more acoustic wave transmitters which send the acoustic wave of the specific frequency set as the location where the transit environment of an automatic guided vehicle was defined beforehand, The dispatch control section which the period of the clock which outputs a signal, and said each of two or more acoustic wave transmitter is carried out [control section] to an output signal from said clock, and makes them send to it in order with a fixed time interval, The electric-wave transmitter which sends the output signal of said clock by the electric wave of a specific frequency, The acoustic wave receiver which will output a signal if the acoustic wave of a frequency which it is set as said automatic guided vehicle, and said acoustic wave transmitter sends is inputted, The electric-wave receiver which receives the electric wave of the frequency which said electric-wave transmitter sends, and outputs a signal, The apparent-signal-delay measuring instrument to which the time delay from the output signal with which said electric-wave receiver of the output signal of said acoustic wave receiver corresponds is measured, and an output signal is changed according to this time delay, Said acoustic wave transmitter which is a source of acoustic wave dispatch is specified from the output signal of an electric-wave receiver the first half corresponding to the output signal of said acoustic wave receiver. With the output signal of said apparent-signal-delay measuring instrument Positioning equipment of the automatic guided vehicle characterized by having the computing element which calculates the distance between said acoustic wave transmitter which is a source of acoustic wave dispatch, and said acoustic wave receiver, and asks for the location of said automatic guided vehicle.
[Claim 2] It is positioning equipment of an automatic guided vehicle according to claim 1 with which two acoustic wave receivers are installed in the location where it differs on an automatic guided vehicle, and a computing element asks for the location and sense of an automatic guided vehicle.
[Claim 3] Positioning equipment of an automatic guided vehicle according to claim 2 with which two acoustic wave receivers were installed in the edge on an automatic guided vehicle which carries out a counter electrode.

[Detailed Description of the Invention]
[0001]
[Industrial Application] Especially this invention relates to the equipment which performs the location of an automatic guided vehicle, and position measurement by the acoustic wave about the positioning equipment of an automatic guided vehicle.
[0002]
[Description of the Prior Art] The positioning equipment of the conventional automatic guided vehicle has the device under test 14 prepared on the automatic guided vehicle 11, the horizontally pivotable ultrasonic transmission-and-reception wave component 12 prepared in the automatic guided vehicle 11, the station 13 installed in the transit environment of an automatic guided vehicle 11, and the station 13 as shown in beans 2 (for example, JP,61-084579,A). Actuation of the positioning equipment of this conventional automatic guided vehicle carries out the revolution scan of the ultrasonic transmission-and-reception wave component 12, transmits a supersonic wave one by one, and detects the travelling period of the reflected wave from a device under test 14, reflective signal strength, and the revolution scan include angle of the ultrasonic transmission-and-reception wave component 12. The relative relation between an automatic guided vehicle 11 and a station 13 is detected from these detection results.
[0003]
[Problem(s) to be Solved by the Invention] With the positioning equipment of this conventional automatic guided vehicle, since it was made to reflect in the device under test in which the supersonic wave emitted from the ultrasonic transmission-and-reception wave component prepared on the automatic guided vehicle was formed on the station and was asking for the relative-position relation between an automatic guided vehicle and a station, when an obstruction existed between an automatic guided vehicle and a station, there was a problem that measurement became impossible. Moreover, when ultrasonic reflective objects other than a non-measuring object existed in the surroundings, distinction of the reflected wave from a device under test and the other ultrasonic reflective object did not stick, but there was a problem that measurement became impossible.
[0004]
[Means for Solving the Problem] Two or more acoustic wave transmitters which send the acoustic wave of a specific frequency by which the positioning equipment of the automatic guided vehicle of this invention was set as the location where the transit environment of an automatic guided vehicle was defined beforehand, The dispatch control section which the period of the clock which outputs a signal, and said each of two or more acoustic wave transmitter is carried out [control section] to an output signal from said clock, and makes them send to it in order with a fixed time interval, The electric-wave transmitter which sends the output signal of said clock by the electric wave of a specific frequency, The acoustic wave receiver which will output a signal if the acoustic wave of a frequency which it is set as said automatic guided vehicle, and said acoustic wave transmitter sends is inputted, The apparent-signal-delay measuring instrument to which the time delay from the output signal with which said electric-wave receiver of the output signal of said acoustic wave receiver corresponds is measured, and an output signal is changed according to this time delay, Said acoustic wave transmitter which is a source of acoustic wave dispatch is specified from the output signal of an electric-wave receiver the first half corresponding to the output signal of said acoustic wave receiver. With the output signal of said apparent-signal-delay measuring instrument It has the computing element which calculates the distance between said acoustic wave transmitter which is a source of acoustic wave dispatch, and said acoustic wave receiver, and asks for the location of said automatic guided vehicle.
[0005] The positioning equipment of the automatic guided vehicle of this invention is installed in a different location on an automatic guided vehicle, and you may make it, as for a computing element, two acoustic wave receivers ask for the location and sense of an automatic guided vehicle.
[0006]
[Example] Next, this invention is explained with reference to a drawing.
[0007] Drawing 1 is the block diagram of one example of this invention. The positioning equipment of the automatic guided vehicle of this example consists of equipment installed in an automatic guided vehicle, and equipment installed in a transit environment.

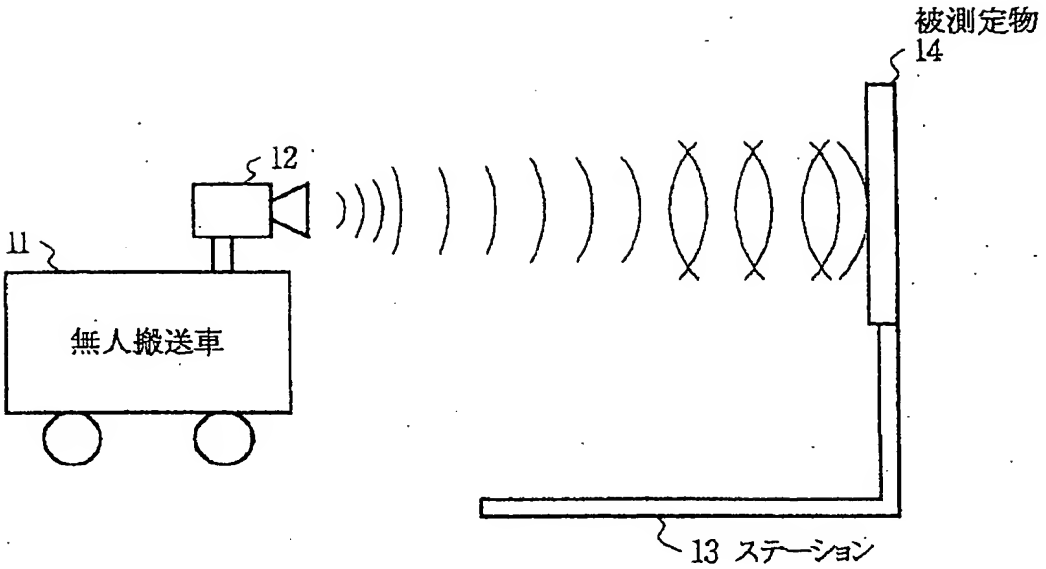
[0008] Two or more acoustic wave transmitters 7 which send the acoustic wave of a specific frequency by which the equipment installed in a transit environment was installed in two or more locations where the coordinate within a transit environment has become clear, The highly precise time amount 8 which repeats that only the number of the acoustic wave transmitters 7 outputs a signal with a fixed time interval after the predetermined quiescent time, The electric-wave transmitter 9 which is connected to a clock 8 and transmits the output signal of a clock 8 to the electric-wave receiver 4 by the electric wave of a specific frequency, It connects with a clock 8 and two or more acoustic wave transmitters 7, and is constituted by the dispatch control section 10 which repeats setting a time interval fixed in order and making each one acoustic wave transmitter 7 of every send synchronizing with the output signal of a clock 8.
[0009] The acoustic wave receiver 2 which will output a signal if the acoustic wave of the specific frequency installed in one edge of an automatic guided vehicle 1 inputs the equipment installed in an automatic guided vehicle 1, The acoustic wave receiver 3 which will output a signal if the acoustic wave of the specific frequency installed in the edge in which the acoustic wave receiver 2 of an automatic guided vehicle 1 was installed, and the edge which carries out a counter electrode inputs, The electric-wave receiver 4 which receives the electric wave of a specific frequency and outputs a signal, It connects with the electric-wave receiver 4 at the acoustic wave receiver 2 and acoustic wave receiver 3 list, and the output signal of the acoustic wave receiver 2 and the acoustic wave receiver 3 is compared with the output signal of the electric-wave receiver 4. The time delay from the output signal of the electric-wave receiver 4 of each output signal of the acoustic wave receiver 2 and the acoustic wave receiver 3 The apparent-signal-delay measuring instrument 5 to which is asked and an output signal is changed according to a time delay, Connect with the electric-wave receiver 4 and the apparent-signal-delay measuring instrument 5, specify the acoustic wave transmitter 7 which is the source of release of the acoustic wave which carries out counting of the output signal of the electric-wave receiver 4, and sings it, and the distance of the acoustic wave receiver 2 and the acoustic wave receiver 3, and the acoustic wave transmitter 7 that is an acoustic wave source of release from the output signal of the apparent-signal-delay measuring instrument 5 It is constituted by the computing element 6 which detects and detects the coordinate and position of an automatic guided vehicle 1.
[0010] Next, order is explained for an operation of this example, and actuation later on.
[0011] The transmitter control section 10 sets a fixed time interval from each of the acoustic wave transmitter 7 with the output signal of a clock 8, and makes it send one acoustic wave at a time to fixed sequence. The electric-wave transmitter 9 synchronizes an echo sounder, and sends the output signal of a clock 8 to the electric-wave receiver 4. The apparent-signal-delay measuring instrument 5 installed in the automatic guided vehicle 1 performs a comparison for the output signal of the acoustic wave receiver 2 and the acoustic wave receiver 3 with the output signal of the electric-wave receiver 4, detects the time delay from the output signal of the acoustic wave receiver 2 and the electric-wave receiver 4 of the output signal of the acoustic wave receiver 3, and changes the output signal of the apparent-signal-delay measuring instrument 5 according to a time delay.
[0012] The time delay from the output signal of the electric-wave receiver 4 of the output signal of the acoustic wave receiver 2 with which the computing element 6 was detected by the apparent-signal-delay measuring instrument 5, and the acoustic wave receiver 3, Singing which carried out counting of the output signal of the electric-wave receiver 4, and was caught with the acoustic wave receiver 2 and the acoustic wave receiver 3 specifies singing from which acoustic wave transmitter 7 it is, and the travelling distance of the acoustic wave to the acoustic wave receiver 2 and the acoustic wave receiver 3 from each acoustic wave transmitter of the acoustic wave transmitter 7 is found from the velocity of propagation of a known acoustic wave. Furthermore, a computing element 6 detects each coordinate of the acoustic wave receiver 2 and the acoustic wave receiver 3, i.e., the location of an automatic guided vehicle 1, based on the distance detected from the acoustic wave transmitter 7 with which the coordinate has become clear. Moreover, a computing element 6 detects the sense of an automatic guided vehicle 1 from the coordinate of the acoustic wave receiver 2, and the coordinate of the acoustic wave receiver 3.
[0013] In addition, let the travelling period of the acoustic wave from each acoustic wave transmitter 7 to the acoustic wave receivers 2 and 3 be a thing shorter than the time interval of the output signal

of a clock 8.
[0014] In this example, the coordinate and position within the transit environment of an automatic guided vehicle 1 can be measured to high degree of accuracy by installing the acoustic wave transmitter group 7 in the transit environment of an automatic guided vehicle 1 so that the acoustic wave receiver 2 and the acoustic wave receiver 3 may always detect the acoustic wave from three or more acoustic wave transmitters among two or more acoustic wave transmitters 7.
[0015] In addition, although it was made for time amount 8 to output a signal with a fixed time interval after the predetermined quiescent time, you may make it output a signal for the command of positioning of an automatic guided vehicle with a fixed time interval from a carrier beam event from the exterior at this example.
[0016] Moreover, when it is not necessary to detect the sense of an automatic guided vehicle and detects only a location, you may make it form an acoustic wave receiver in an automatic guided vehicle one.
[0017]
[Effect of the Invention] As explained above, since the measuring device of the automatic guided vehicle of this invention installs two or more acoustic wave transmitters in a transit environment and was made to position, even when the each of the acoustic wave obstruction which interrupts an acoustic wave exists in a transit environment, it has the effectiveness that high degree of accuracy can be asked for the coordinate and position of an automatic guided vehicle, by installing an acoustic wave transmitter suitably.

[Drawing 1]



[Drawing 2]


被測定物
14
12
11
無人搬送車
13 ステーション

(19)日本国特許庁（ＪＰ）　(12) 公開特許公報（A）　(11)特許出願公開番号

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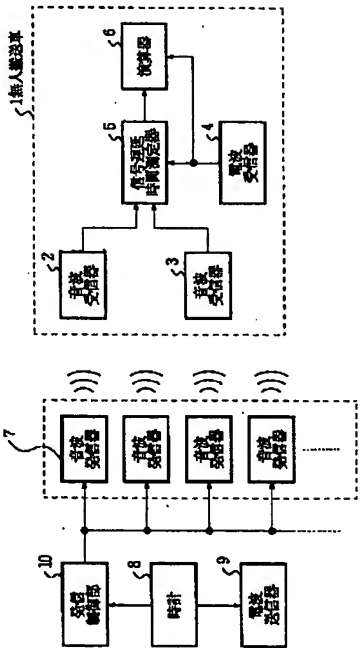
(54)【発明の名称】　無人搬送車の測位装置

(57)【要約】
【目的】無人搬送車の位置と姿勢を高精度に求める。
【構成】発信器制御部１０は、時計８からの信号に同期させて音波発信器７の各々から順番に音波を発信させる。電波送信器９は時計８からの信号を電波で無人搬送車１の電波受信器４へ送る。無人搬送車１は音波受信器２及び３で、音波発信器群７の各々からの音波を受けて信号遅延時間測定器５で電波受信器４で受けた時計８の信号と比較し、音波がどの音波信号機からのものかを特定しその伝搬遅延時間を求め、演算器６により各々の音波発信器からの音波受信器２及び３までの距離を求めることにより無人搬送車の位置を求める。



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【特許請求の範囲】

【請求項１】　無人搬送車の走行環境の予め定められた場所に設定された特定の周波数の音波を発信する複数の音波発信器と、一定の時間間隔で信号を出力する時計と、前記複数の音波発信器それぞれを前記時計からの出力信号に周期して順番に発信させる発信制御部と、前記時計の出力信号を特定の周波数の電波で発信する電波送信器と、前記無人搬送車に設定され前記音波発信器が発信する周波数の音波を入力すると信号を出力する音波受信器と、前記電波送信機が発信する周波数の電波を受信して信号を出力する電波受信器と、前記音波受信器の出力信号の前記電波受信器の対応する出力信号からの遅延時間を測定しこの遅延時間に応じて出力信号を変化させる信号遅延時間測定器と、前記音波受信器の出力信号に対応する前期電波受信器の出力信号から音波発信源である前記音波発信器を特定し前記信号遅延時間測定器の出力信号により音波発信源である前記音波発信器と前記音波受信器との間の距離を計算し前記無人搬送車の位置を求める演算器とを備えることを特徴とする無人搬送車の測位装置。

【請求項２】　２つの音波受信器が無人搬送車上の異なる位置に設置され演算器は無人搬送車の位置と向きを求める請求項１記載の無人搬送車の測位装置。

【請求項３】　２つの音波受信器が無人搬送車上の互いに対極する端に設置された請求項２記載の無人搬送車の測位装置。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は無人搬送車の測位装置に関し、特に音波により無人搬送車の位置及び姿勢測定を行う装置に関する。

【０００２】

【従来の技術】従来の無人搬送車の測位装置は、豆２に示すように無人搬送車１１と、無人搬送車１１に設けられた水平方向に回転可能な超音波送受波素子１２と、無人搬送車１１の走行環境に設置されたステーション１３と、ステーション１３上に設けられた被測定物１４を有している（例えば特開昭６１－０８４５７９号公報）。この従来の無人搬送車の測位装置の動作は、超音波送受波素子１２を回転走査して順次超音波を送波し、被測定物１４からの反射波の伝搬時間と反射信号強度及び超音波送受波素子１２の回転走査角度を検出する。これらの検出結果から無人搬送車１１とステーション１３の相対関係を検出する。

【０００３】

【発明が解決しようとする課題】この従来の無人搬送車の測位装置では、無人搬送車上に設けられた超音波送受波素子から発せられた超音波をステーション上に設けられた被測定物に反射させて無人搬送車とステーションの相対位置関係を求めているため、無人搬送車とステーションの間に障害物が存在する場合測定が不可能になるという問題があった。また、回りに非測定物以外の超音波反射物が存在する場合、被測定物とそれ以外の超音波反射物からの反射波の区別がつかず、測定が不可能になるという問題があった。

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【０００４】

【課題を解決するための手段】本発明の無人搬送車の測位装置は、無人搬送車の走行環境の予め定められた場所に設定された特定の周波数の音波を発信する複数の音波発信器と、一定の時間間隔で信号を出力する時計と、前記複数の音波発信器それぞれを前記時計からの出力信号に周期して順番に発信させる発信制御部と、前記時計の出力信号を特定の周波数の電波で発信する電波送信器と、前記無人搬送車に設定され前記音波発信器が発信する周波数の音波を入力すると信号を出力する音波受信器と、前記音波受信器の出力信号の前記電波受信器の対応する出力信号からの遅延時間を測定しこの遅延時間に応じて出力信号を変化させる信号遅延時間測定器と、前記音波受信器の出力信号に対応する前期電波受信器の出力信号から音波発信源である前記音波発信器を特定し前記信号遅延時間測定器の出力信号により音波発信源である前記音波発信器と前記音波受信器との間の距離を計算し前記無人搬送車の位置を求める演算器とを備えている。

【０００５】本発明の無人搬送車の測位装置は、２つの音波受信器が無人搬送車上の異なる位置に設置され演算器は無人搬送車の位置と向きを求めるようにしてもよい。

【０００６】

【実施例】次に本発明について図面を参照して説明する。

【０００７】図１は本発明の一実施例のブロック図である。本実施例の無人搬送車の測位装置は、無人搬送車に設置される装置と、走行環境内に設置される装置とで構成される。

【０００８】走行環境内に設置される装置は、走行環境内の座標の判明している複数の場所に設置された特定の周波数の音波を発信する複数の音波発信器７と、所定の休止時間の後に一定の時間間隔で音波発信器７の数だけ信号を出力することを繰り返す高精度な時間８と、時計８に接続され時計８の出力信号を特定の周波数の電波で電波受信器４へ送信する電波送信器９と、時計８および複数の音波発信器７に接続され個々の音波発信器７を時計８の出力信号に同期して１つずつ順番に一定の時間間隔をおいて発信させることを繰り返す発信制御部１０によって構成される。

【０００９】無人搬送車１に設置される装置は、無人搬送車１の一方の端に設置された特定の周波数の音波が入力すると信号を出力する音波受信器２と、無人搬送車１の音波受信器２の設置された端と対極する端に設置された特定の周波数の音波が入力すると信号を出力する音波

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受信器３と、特定の周波数の電波を受信して信号を出力する電波受信器４と、音波受信器２および音波受信器３並びに電波受信器４に接続され音波受信器２および音波受信器３の出力信号を電波受信器４の出力信号と比較し音波受信器２および音波受信器３の各々の出力信号の電波受信器４の出力信号からの遅延時間を求め遅延時間に応じて出力信号を変化させる信号遅延時間測定器５と、電波受信器４と信号遅延時間測定器５に接続され電波受信器４の出力信号を計数し鳴音する音波の発生源である音波発信器７を特定し信号遅延時間測定器５の出力信号から音波受信器２および音波受信器３と音波発生源である音波発信器７との距離を検出し無人搬送車１の座標と姿勢を検出する演算器６によって構成される。

【００１０】次に本実施例の作用、動作を順を追って説明する。

【００１１】発信器制御部１０は、時計８の出力信号により音波発信器７の各々から一定の時間間隔をおいて一定の順番に１つずつ音波を発信させる。電波送信器９は音波発信機を同期させて時計８の出力信号を電波受信器４へ発信する。無人搬送車１に設置された信号遅延時間測定器５は音波受信器２及び音波受信器３の出力信号を電波受信器４の出力信号と比較を行い、音波受信器２及び、音波受信器３の出力信号の電波受信器４の出力信号からの遅延時間を検出し、遅延時間に応じて信号遅延時間測定器５の出力信号を変化させる。

【００１２】演算器６は信号遅延時間測定器５により検出された音波受信器２及び音波受信器３の出力信号の電波受信器４の出力信号からの遅延時間と、電波受信器４の出力信号を計数し音波受信器２及び音波受信器３でとらえた鳴音がどの音波発信器７からの鳴音かを特定し、既知の音波の伝搬速度から音波発信器７の各々の音波発信器からの音波受信器２及び音波受信器３までの音波の伝搬距離を求める。さらに演算器６は座標の判明している音波発信器７からの検出した距離を元に音波受信器２及び音波受信器３のそれぞれの座標、すなわち無人搬送車１の位置を検出する。また、演算器６は音波受信器２の座標と音波受信器３の座標から無人搬送車１の向きを検出する。

【００１３】なお、各音波発信器７から音波受信器２，３までの音波の伝搬時間は時計８の出力信号の時間間隔より短いものとする。

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【００１４】本実施例では、複数の音波発信器７の内、常に３個以上の音波発信器からの音波を音波受信器２及び音波受信器３が検出するように音波発信器群７を無人搬送車１の走行環境内に設置することにより、高精度に無人搬送車１の走行環境内での座標と姿勢を測定することができる。

【００１５】なお、本実施例では所定の休止時間後に一定の時間間隔で時間８が信号を出力するようにしたが外部から無人搬送車の測位の指令を受けた時点から一定の時間間隔で信号を出力するようにしてもよい。

【００１６】また、無人搬送車の向きを検出する必要がなく位置のみ検出する場合は無人搬送車に音波受信器を一つのみ設けるようにしてもよい。

【００１７】

【発明の効果】以上説明したように本発明の無人搬送車の測定装置は、走行環境内に複数の音波発信器を設置してその各々の音波を使用して測位を行うようにしたので、走行環境内に音波を遮る障害物が存在する場合でも音波発信器を適宜に設置することにより高精度に無人搬送車の座標と姿勢を求めることができるという効果を有する。

【図面の簡単な説明】

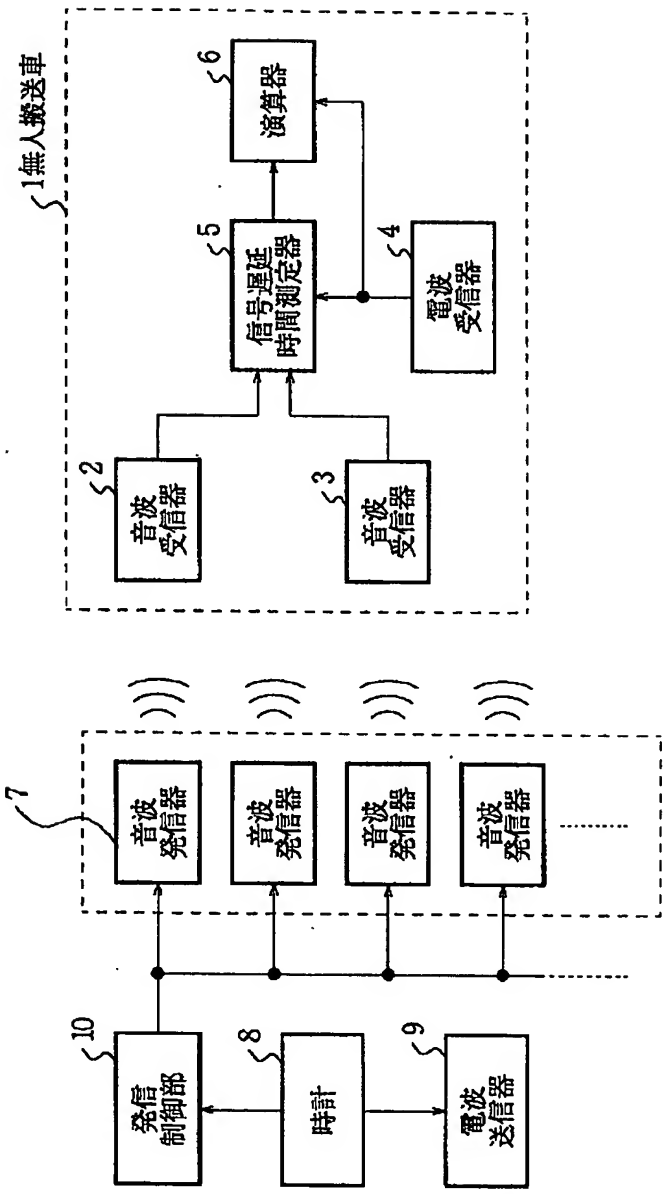
【図１】本発明の一実施例を示す構成図である。

【図２】従来の無人搬送車の測位装置を示す構成図である。

【符号の説明】

１，１１　無人搬送車
２，３　音波受信器
４　電波受信器
５　信号遅延時間測定器
６　演算器
７　音波発信器群
８　時計
９　電波発信器
１０　発信制御部
１２　超音波送受波素子
１３　ステーション
１４　非測定物

【図１】


1無人搬送車
2
音波受信器
3
音波受信器
4
電波受信器
5
信号遅延時間測定器
6
演算器
7
音波発信器
音波発信器
音波発信器
音波発信器
8
時計
9
電波送信器
10
発信制御部

【図２】